XIII Congresso de ECOLOGIA
III International Symposium of Ecology and Evolution
Múltiplas ecologias: evolução e diversidade
08 a 12 de outubro de 2017 • UFV - VIÇOSA | MG

Tadpoles at different angles: how oral morphology and substrate orientations modify feeding efficiency

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Tema/Meio de apresentação: Ecologia Comportamental/Oral

Tadpoles have a complex oral anatomy, with structures that can vary in shape and configuration. However, the functional implications of this variation are unclear. We conducted an experimental study to test the hypothesis that variation in oral morphology influences feeding efficiency in substrates positioned in five different orientations: 0°, 45°, 90°, 135° and 180°. We predicted that (i) tadpoles would present higher growth rates when foraging at 0°, once they could obtain more food with less energy costs (buoyancy and swimming); (ii) complexity in oral configuration (e.g. more denticle rows) would increase feeding efficiency at different angles. We analyzed the effect of the angles and the morphological differences on the relative increase in weight and body size in five species from two different ecomorphological guilds. General linear models evidence that all species performed better in substrates at angles of 0° and 180°. Possibly in substrates positioned at angles of 45°, 90° and 135° tadpoles must swim up and down while grazing, increasing energetic costs in comparison to floatation in the horizontal angles. Species from the same guild had different growth rates that were related to the variation in their oral morphology (but not to the increase in complexity of these structures), the angles of substrates (nektonic tadpoles) and probably to differences in feeding behavior (benthic tadpoles). Also, among tadpoles with the same oral configuration, growth rate of nektonic tadpoles was different to one of the benthic species tested, but similar to the other. Competition is inferred to be reduced among tadpoles because food resource, especially in ephemeral ponds, is considered abundant. However, we found evidence that oral anatomy and morphology together can be a constraint of feed efficiency of tadpoles, leading to spatial and feeding niche partitioning in consequence of competition, which can lead species to explore different habitat dimensions.

The authors thank L.H. Florindo for providing infrastructure at the laboratory; FSA receives a fellowship from CAPES.